Assessing women’s knowledge and attitudes toward cord blood banking: policy and ethical implications for Jordan

Monica M. Matsumoto,1,2,3 Rana Dajani,2,4 Yousef Khader,5 and Kirstin R.W. Matthews1

BACKGROUND: Despite the global expansion of umbilical cord blood (CB) banking, little is known about public opinion and awareness, especially among Arab Muslim populations. CB banking raises policy questions about funding sustainability and quality standards, as well as ethical debates about profitability, informed consent, and medical justification. This study is the first of its kind in the Arab world, and Jordan has a unique, understudied, yet highly relevant setting, especially as a regional medical hub with advanced medical and health policy infrastructures. In addition, the first private and public CB banks are expected to open in 2016.

STUDY DESIGN AND METHODS: The authors developed and administered, over a 5-month period, an anonymous survey to investigate public opinion and knowledge about CB banking in Jordan. The survey was administered to women in maternity outpatient clinic waiting rooms at five different hospitals.

RESULTS: More than 75% of respondents indicated they knew nothing about CB banking in Jordan, and more than 50% had never heard of CB banking before. However, overall public opinion about CB storage is positive. Important factors related to public opinion about CB banking were also identified, demonstrating that most women want more information on CB banking, especially from their obstetrician.

CONCLUSION: This widespread lack of awareness is likely contributing to misinformation, lack of knowledge, and unfavorable perspectives toward CB donation and research. The results have important implications for the development of national and regional policies and educational campaigns on CB banking targeting both physicians and patients.

In the past 15 years since its inception, umbilical cord blood (CB) banking has become a major component of processing and storing CB units for transplant and research purposes. CB banking has expanded worldwide, including several new initiatives in the Arab world. Despite this growth, several studies, conducted primarily in North America and Western Europe, have identified extensive misinformation about CB banking but overall positive public opinion, especially regarding CB donation programs.1-8 This study is the first of its kind to assess public attitudes and awareness about CB banking in the Hashemite Kingdom of Jordan and has important implications for program development, ethical considerations, and policies as CB banking continues to expand in the Arab world.

Jordan is a regional hub for medical tourism and has recently expanded its efforts to support a CB banking program. Among Arab countries, Jordan dedicates the highest percentage of its gross domestic product and total government spending on health expenditures (Table 1). Jordan's

ABBREVIATIONS: CB = cord blood; JOD = Jordanian dinars; SC = stem cell.

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that will house Jordan’s first public CB bank. In January
a $93 million expansion of King Hussein Cancer Center
lion stem cell (SC) research facility at Jordan University and
capital governorate of Amman, including a new $18.5 mil-
health care and research facilities are concentrated in the
region.20 The government passed the region’s first regulatory
law for SC research and CB banking, putting Jordan at the
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Several medical, cultural, and demographic factors in
Jordan are relevant when considering local CB banking
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standards, and misleading advertisements.

Currently, the only available CB banking option in
Jordan is through private companies, which charge fami-
lies $2000 to $3000 to store the CB unit in a facility outside
of Jordan in case of a future transplant need. The most
prominent private CB bank—BabyCord Jordan—has
already built a CB storage facility in Jordan but currently
ships CB units to the New England CB Bank (Boston, MA)
until it receives government licensure to open in-country
storage. Private CB banking is financially inaccessible for
the majority of Jordan’s population, and it is generally not
supported by a number of medical institutions, including
the American Society for Blood and Marrow Transplanta-
tion, American Academy of Pediatrics, and the Royal Col-
lege of Obstetricians and Gynecologists for a variety of
reasons, including high costs, low value, unverified quality
standards, and misleading advertisements.

Several medical, cultural, and demographic factors in
Jordan are relevant when considering local CB banking

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Statistic</th>
<th>Year</th>
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<tbody>
<tr>
<td>Population estimate†‡</td>
<td>9.5 million</td>
<td>2015</td>
</tr>
<tr>
<td>Muslim, Christian</td>
<td>97.2%</td>
<td>2010</td>
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<tr>
<td>Annual population growth rate</td>
<td>5.3%</td>
<td>2004-2015</td>
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<tr>
<td>Average family size</td>
<td>4.82</td>
<td>2015</td>
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<tr>
<td>Life expectancy at birth (years): females, males</td>
<td>75.8, 73.0</td>
<td>2015</td>
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<tr>
<td>Median age (years) of women at first marriage</td>
<td>21.2</td>
<td>2015</td>
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<tr>
<td>Rate of consanguineous marriage‡</td>
<td>35%</td>
<td>2012</td>
</tr>
<tr>
<td>Percentage of women never married by end of reproductive years</td>
<td>3%</td>
<td>2015</td>
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<tr>
<td>Total fertility rate (births/woman)§</td>
<td>3.17</td>
<td>2015</td>
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<tr>
<td>Secondary school enrollment rates: females, males</td>
<td>57.5, 65.9</td>
<td>2015</td>
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<tr>
<td>Adult illiteracy rate: females, males</td>
<td>8.9, 4.6</td>
<td>2015</td>
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<tr>
<td>Income level category¶†</td>
<td>Upper mid income</td>
<td>2015</td>
</tr>
<tr>
<td>Gross national income per capita**</td>
<td>$5,160</td>
<td>2014</td>
</tr>
<tr>
<td>Health expenditures as: % gross domestic product, % total government spending</td>
<td>8.4%, 17.6%</td>
<td>2011</td>
</tr>
<tr>
<td>Ministry of Health budget as % total government budget</td>
<td>8.0%</td>
<td>2014</td>
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<tr>
<td>Physicians/10,000 population</td>
<td>29.4</td>
<td>2014</td>
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<tr>
<td>Hospital beds/10,000 population</td>
<td>18.0</td>
<td>2014</td>
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<tr>
<td>Primary health care centers/10,000 population</td>
<td>2.4</td>
<td>2014</td>
</tr>
<tr>
<td>Population covered by health care insurance</td>
<td>55%</td>
<td>2015</td>
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<tr>
<td>Number of public hospitals (% of total beds)</td>
<td>31 (39%)</td>
<td>2014</td>
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<tr>
<td>Number of private hospitals (% of total beds)</td>
<td>59 (34%)</td>
<td>2014</td>
</tr>
<tr>
<td>Number of Royal Medical Services hospitals (% of total beds)</td>
<td>11 (18%)</td>
<td>2014</td>
</tr>
<tr>
<td>Number of university hospitals (% of total beds)</td>
<td>2 (9%)</td>
<td>2014</td>
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<tr>
<td>Hospital beds in Amman, Zarqa Governorates (as % of total beds)</td>
<td>56%, 10%</td>
<td>2014</td>
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<tr>
<td>Antenatal care coverage: ≥ 1 visit, 4 visits, from physician</td>
<td>99%, 94%, 96%</td>
<td>2012</td>
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<tr>
<td>Births attended by: skilled health personnel, physician</td>
<td>100%, 76%</td>
<td>2012</td>
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<tr>
<td>Births delivered in medical facility (public, private)</td>
<td>99% (65%, 34%)</td>
<td>2012</td>
</tr>
<tr>
<td>Incidence of leukemias†† among Jordanians as % of total cancer cases (male, female, pediatric)</td>
<td>6%, 4%, 38%</td>
<td>2010</td>
</tr>
<tr>
<td>Incidence of lymphomas††† among Jordanians as % of total cancer cases (male, female, pediatric)</td>
<td>10%, 8%, 20%</td>
<td>2010</td>
</tr>
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</table>

* These indicators were chosen based on their relevance to CB banking. The statistics were adapted principally from Jordanian government
sources, including the 2015 Population & Housing Census and 2012 Population & Family Health Survey, with secondary information from
the World Factbook and World Bank. Sources are listed next to each corresponding statistic.
† Population estimate based on 2015 census data and includes both Jordanians and non-Jordanians.
‡ Consanguineous marriage definition: “union between two individuals who are related as second cousins or closer.”
§ TFPR definition: “the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear
children in accordance with current age-specific fertility rates.”
† Describes school enrollment among 16- to 18-year-olds.
¶ Calculated using the World Bank Atlas method for the current 2015 fiscal year, with middle-income economies having a GNI per capita of
more than $1045 but less than $12,746.
** GNI per capita definition: “gross national income, converted to US dollars using the World Bank Atlas method, divided by midyear popula-
tion. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output
plus net receipts of primary income (compensation of employees and property income) from abroad.”
†† Lymphoma (including non-Hodgkin’s and Hodgkin’s) is the third most common cancer affecting Jordanians (males and females; 7.9%, n = 382); leukemia is the fifth most common cancer affecting Jordanian males (5.5%, n = 127); non-Hodgkin’s lymphoma is the fourth
most common cancer affecting Jordanian females (5.2%, n = 130); and leukemia (38%, n = 74) and lymphoma (20%, n = 39) account for
the majority of cancers in pediatric patients.
programs. Leukemias and lymphomas, for which CB transplants have become standard therapies, are among the most common cancers affecting the population and account for the majority of pediatric cases (Table 1).15 Consanguineous marriages (a union between two individuals related as second cousins or closer) remain a common practice in Jordan and are often the favored form of marriage (Table 1).20 Consanguinity has been attributed to high rates among Arab populations of autosomal recessive disorders, such as thalassemia and other hemoglobinopathies, for which CB transplants are an established treatment.20,21 This practice may also contribute to the high rates of autosomal recessive genetic disorders listed on the Catalogue for Transmission Genetics in Arabs database.21 High success rates of finding a HLA-matched hematopoietic SC donor in Jordan may be due to consanguinity and large family sizes; in addition, practices for collecting CB units with high total nucleated cell and CD34+ cell counts have been established in facilities in Jordan.21-23 These statistics are relevant in terms of childbirth since nearly all births in Jordan take place within marriage, family sizes remain relatively large, and the vast majority of women get married before the end of their reproductive years (Table 1).14 These factors are important indicators for CB banking programs and are unique to Jordan, as well as many countries in the Arab world.

Despite these factors supporting CB banking programs, little is known about local public knowledge and opinion on the issue. For example, women in general tend to overestimate the likelihood of using CB for autologous or related allogeneic transplants.2,3 Misinformation about CB banking can have negative consequences on the distribution and utilization of resources, both financially and medically. This study demonstrates a need for educational initiatives and policies that are tailored to Jordan's unique needs and viewpoints and can help other CB banking programs in the region develop in a culturally and ethically appropriate manner.

MATERIALS AND METHODS

The study questionnaire, “Umbilical Cord Blood Banking: Public Opinion and Awareness in Jordan,” was developed by the authors to analyze the attitudes of women in Jordan toward CB storage, donation, and research (Supplemental Materials, A and B, available as supporting information in the online version of this paper). The authors translated the questionnaire word for word, with minor grammar-related exceptions, from English to Arabic to allow participants to choose their preferred language. Both the survey and the study were approved for exemption by the Institutional Review Board at Rice University, Houston, Texas, as well as each hospital administration where the surveys were administered.

The questionnaire used multiple choice, Likert-scale, and coded short-answer formats. The first section collected information about sociodemographic factors, including age, children, education, religion, household income, and marital status. The second part measured existing knowledge and beliefs about the field of CB banking and transplants, including sources of information and obstetrician communication. The last part investigated opinions and preferences about issues relevant to CB banking, such as CB bank type (public, private, hybrid), location, donation, and information sources.

The survey was administered to women in maternity outpatient clinic waiting rooms, January to April 2015. Five hospitals (four private, one public) in the Amman governorate and one (public) hospital in the Zarqa governorate were included, as more than 80% of Jordan's population is urban and 90% live either in or north of Amman.24 Consent was gained verbally and through a printed information sheet (Supplemental Materials, C and D, available as supporting information in the online version of this paper), and the questionnaire was completed on site. Only women age 18 and older took the survey due to the nature of the topic's relation to pregnancy and childbirth. In addition, most of the women were either mothers or expectant mothers, making the topic directly relevant. A total of 899 surveys were collected. The return rate was 100%, but the completion rate for each question varied. A pilot questionnaire was completed by 19 women.

Data were analyzed using computer software (Microsoft Excel 2011, Microsoft Corp.; and SPSS [Statistical Package for Social Sciences], SPSS, Inc.). Participants' socio-demographic characteristics were described using frequency distribution, and chi-square tests were used to describe categorical data. Odds ratios were calculated with a 95% confidence interval. A p value of less than 0.05 was considered significant.

RESULTS

Sociodemographic characteristics

Table 2 summarizes the sociodemographic characteristics from the 899 collected study questionnaires. Response rate varied among questions, from 99.8% to 78.0%, with a mean of 90.8%. All survey participants were female, and 66% (n = 584) already had at least one child. The median age was 29 years old, and the median household monthly income was 250 to 500 Jordanian dinars (JOD; approx. 350-700 USD). Most respondents were Muslim and married and had at least completed a secondary education or technical diploma. The question about birthplace had the lowest response rate of all the survey questions (78%, n = 700), but 74% (n = 518) of respondents put Jordan as their birthplace. Most participants indicated that they had no family history of diseases treated by CB transplants,
such as hematologic disorders, immune deficiencies, and metabolic disorders. As expected, prior participation in any sort of CB banking (public, private, or hybrid) was very low. The sample population was generally representative of Jordan’s overall demographic characteristics, including marriage, religion, and household income.

Knowledge and awareness

The study participants had a very low level of knowledge about CB banking and related topics (Table S1, available as supporting information in the online version of this paper). Only 11% (n = 90) of respondents reported having a high level of prior knowledge of SC transplants, while 54% (n = 458) reported a low level of knowledge. Most women reported a low level of knowledge of CB transplants (69%, n = 567) and CB banking: 77% (n = 633) for public CB banking, 79% (n = 646) for private CB banking, and 87% (n = 713) for hybrid CB banking. Women with a higher educational level and household income were more likely to have heard of CB banking (p < 0.05; Table S2, available as supporting information in the online version of this paper). Overall, 4% (n = 33) of respondents said they have previously stored CB, 55% (n = 18) of whom specified private CB storage.

Attitudes and opinions

Overall, respondents supported public CB donation more than private CB storage (Fig. 1, Table S3, available as supporting information in the online version of this paper). In addition, several factors suggest a higher likelihood of storing CB if presented with a future opportunity. The majority of respondents agreed that they would be more likely to store CB if their obstetrician recommended it (Fig. 1). Participants with higher education and income levels were more likely to have discussed CB banking with their obstetrician (Table S2). A higher education level was positively associated with a greater willingness to pay for private CB storage.  

Fig. 1. Participants’ agreement with statements about CB banking according to educational level. Survey participants were presented with several statements about CB banking and were asked to respond on a scale of 1 (strongly disagree) to 5 (strongly agree). The figure summarizes the data of women who agreed with each statement (corresponding to answers of 4 or 5 on the scale). (□) Would donate CB to public bank (n = 349); (□) would pay for private CB storage (n = 255); (△) would like more info on CB banking (n = 530); (×) would more likely store CB if doctor recommended (n = 461). *Significant relationship (p < 0.05).
believed using CB for transplant and research was ethically acceptable or had a neutral opinion, while a minority disagreed with using CB for these purposes (Table S4, available as supporting information in the online version of this paper). Respondents who had existing knowledge about SC transplants in general were more likely to consider using CB for transplant and research to be ethically acceptable and were more willing to donate CB for research ($p < 0.05$)—a common option if the CB unit has insufficient CD34$^+$ and total nucleated cell counts (Fig. 2). No significant relationship was found between willingness to donate CB to research and educational level or income, although women who had a higher level of general knowledge about SC transplants indicated a greater willingness to donate CB for research ($p < 0.05$). Figure 3 summarizes respondents’ viewpoints on a list of issues relevant to future participation in CB banking. Participants’ viewpoints on the issues of safety, medical benefit, religious compatibility, proximity, and altruism were not significantly correlated with age or educational background. With regard to consent for collecting and storing CB, 78% ($n = 1027$) of women wanted at least one parent, with slightly more for the mother ($n = 516$) than the father ($n = 511$). Thirty-six percent ($n = 296$) believed that only one parent should provide consent, split nearly equally between only the mother (18%, $n = 149$) and only the father (18%, $n = 147$). Overall, 43% ($n = 353$) wanted at least both parents to provide consent, and 28% ($n = 227$) wanted the obstetrician involved.

**Preferences and information**

When asked about the optimal location for a CB bank, most respondents preferred storage in Jordan, citing the most important reasons as accessibility or transport issues (39%, $n = 454$), safety or security concerns (21%, $n = 246$), and confidence in services or quality (12%, $n = 141$; Table S5, available as supporting information in the online version of this paper). Among those who preferred international storage, the most popular location was Europe (33%, $n = 41$), followed by the Middle East (outside of Jordan; 24%, $n = 29$), and North America (20%, $n = 25$), with the most common reasons being type of technology or equipment (24%, $n = 44$), safety or security concerns (17%, $n = 44$), and confidence in services or quality (16%, $n = 41$). Women with lower family incomes (<1000 JOD [<1400 USD]) were more likely to prefer storage in Jordan than women in higher income categories (>1000 JOD (>1400 USD)), who especially favored Europe and North America ($p < 0.05$; Table S5). Finally, 66% ($n = 531$) of respondents agreed that they would like to receive more information about CB banking, although 10% ($n = 80$) did not want more information, and 24% ($n = 196$) were neutral. When asked about preferred sources of information, 71% ($n = 603$) chose their obstetrician, accounting for 40% of all responses. The least preferred sources of information were a nurse or midwife (2%, $n = 23$), the government (4%, $n = 63$), and mass media (8%, $n = 112$). Participants’ preferences demonstrate a discrepancy with actuality (Fig. 4). Only 7% ($n = 61$) of respondents said their obstetrician had discussed CB banking with them.

**DISCUSSION**

This research is a major step in gathering data on women’s preferences and knowledge about the rapidly expanding field of CB banking in Jordan. Previous surveys conducted in other countries have identified inaccurate or insufficient information as the most important obstacle to public CB donation programs.$^{2,3,6,25}$ In addition to being the first independent survey in the Arab world about CB
banking, this survey is the first to be conducted in a Muslim majority country, providing new cultural and religious perspectives relevant to other regional and international CB banking programs.

Our results suggest a high level of support for a national CB banking program in Jordan with the majority of respondents preferring CB storage in Jordan rather than internationally (Table S5). Women cited easier accessibility, safety or security concerns, and scientific research opportunities as justifications for wanting a CB bank in Jordan, suggesting an overall confidence in storing CB in Jordan and a broader public interest in the scientific benefit of having a CB banking program. Women who preferred international storage were most concerned about
technology and equipment type, although Jordan’s recent regulatory law could help address this concern. King Hussein Cancer Center is the only institution in Jordan to be currently transplanting CB units, but it has had to largely rely on the expensive process of importing CB from international registries. A local CB bank could increase matching and success rates for both autologous and allogeneic SC transplants in Jordan and the broader Arab world.

The current domination of CB banking by private companies in Jordan may explain the public’s misinformation, confusion, and negative or neutral outlooks on CB transplants, research, and storage. Importantly, private health care facilities in Jordan are largely considered to be superior to public ones in terms of quality and service, so preconceptions about the difference between family or private CB storage and public CB donation may exist. For example, women who had never heard of CB banking before were more likely to support private CB banking but not public banking (p < 0.05), and women who selected quality standards as an important issue were significantly more likely to support private CB banking (p < 0.05). This relationship was not seen with public CB banking. In addition, participants’ low level of knowledge about hybrid CB banking is likely related to the low favorability it received (Table S1). Such misconceptions, if perpetuated, could have deleterious effects on the development of CB banking in Jordan.

Our results indicate an overall dissatisfaction with the sources, availability, and quality of information about CB banking in Jordan. Mass media was the most common but one of the least favored sources of information in our study (Fig. 4). However, the provision of accurate, unbiased information available to the public can mitigate public concerns about mother or newborn safety and ethical uncertainties, as well as elucidate common misconceptions about the utility of private CB banks. Word of mouth through a family member or friend was second and may be especially high in Jordan, as a family-centered society. The Facebook pages for “BabyCord Jordan” and “King Hussein Cancer Foundation and Center” have more than 58,000 and 682,000 likes, respectively, as of January 2016, and online sources will be increasingly important as connectivity continues to rise. Women who had heard about CB banking from a pamphlet in clinic waiting rooms reported significantly higher levels of knowledge about the CB banking field, including SC transplants and types of CB bank, and should be considered an effective means of communicating information, especially with high literacy rates.

According to our data, obstetricians in Jordan rarely discuss CB banking with their patients despite high levels of antenatal care and a high regard for obstetrician recommendations. This gap may be due to the limited CB banking options, newness of the field, and lack of physician knowledge. Private CB banks often communicate directly with the parents rather than the obstetrician and may not provide adequate information about the limits of family CB banking or details about quality standards. Women in our study who had discussed private CB banking with their obstetrician were more likely to support private rather than public CB banking (p < 0.05). Most respondents agreed that they would be more likely to store CB if an obstetrician recommended it, but if obstetricians are not adequately informed about CB banking, they may be unable to answer patients’ questions. Therefore, educational initiatives should target obstetricians to ensure that they are able to provide detailed information on the field. Regulatory mechanisms about mandatory disclosures and conflicts of interest between CB banks and physicians should also be established to mitigate ethical problems.

Parental consent and religious approval for collecting, storing, and using CB were important issues and should be incorporated into banking policies. International standards for CB collection require that consent be obtained from the mother but not the father. Interestingly, many respondents preferred paternal consent, which may be due to the legal and cultural role in Jordanian society of the father, who often retains authority for major decisions related to children. In addition, Jordan has one of the highest levels of religiosity in the world. From a broad Islamic perspective, public CB banking is favored over private CB storage based on the principles of promoting public good and preventing harm: “there is no ethical or moral objection to [cord blood’s] use . . . [cord blood] donation should be encouraged,” and moral considerations about personhood are not an issue with adult SCs. There was no correlation between importance of religion in relation to CB banking and preference for type of CB banking (e.g., public, private, hybrid). The distinction women made between religion and culture—with the former being a much more important factor—suggests an openness to new medical therapies and practices, especially when in agreement with religious precepts. These preferences have particular consequences for CB banking policies in Jordan, as well as other Arab and Muslim countries, and should be given special consideration as it differs from other programs.

Participants’ low regard for altruism or public benefit is inconsistent with other studies from around the world, which found altruism to be one of the most important incentives for women to participate in CB banking, especially a public program. This discrepancy may be due to a lack of awareness about the benefits of CB donation since public attitudes about blood donation are generally positive. Despite the overall low importance of altruism in this study, women who agreed that they would like to donate CB to a public bank were significantly more likely to have said altruism or public benefit was important. This relationship suggests that more information about
the benefits of public CB donation could change the public’s mindset about CB banking.

A few limitations should be taken into consideration when assessing this study. The refusal rate was not recorded, and some women did not answer questions with specific formats, such as the fill-ins and scales, or were unable to finish due to time constraints, misunderstanding, illiteracy, personal reasons, and/or technical errors. The percentage of women born in Jordan is likely overrepresented in our data, since women born outside of Jordan may have been uncomfortable putting their place of birth. This reluctance may be due to a variety of reasons, including sensitivities about nationality, political misrepresentation, and the status of refugees. Definitions were provided at the beginning of the survey, but participants may not have read them thereby potentially limiting their ability to answer the questions.

This research demonstrates the importance of gathering in-country data on CB banking for policy-making and future research purposes in Jordan and the broader Arab region. CB banking guidelines and programs should account for paternal consent and religious beliefs, as well as disclosures of potential conflicts of interest. Workshops and trainings for health care professionals should be conducted to foster knowledge about CB collection and processing procedures and to increase physician–patient communication. Future research should be conducted among obstetricians in Jordan to determine their knowledge of CB banking and identify areas where more information is needed, which is especially important when considering the role of obstetricians in families’ decision-making in Jordan. In addition, our data suggest that waiting room pamphlets and Arabic-English websites are effective means of disseminating information. As CB banking continues to expand in the Arab world, this research is a critical step in elucidating issues of public concern and identifying areas of weakness that should be prioritized.

ACKNOWLEDGMENT

We thank Nuha Ahmad for assistance in surveying women at the Zarqa Government Hospital. MMM was the principal investigator and takes primary responsibility for the paper; MMM, KRWM, and RD developed the questionnaire; MMM and NA recruited the participants; MMM, KRWM, and RD wrote the paper; and YK and MMM conducted the statistical analysis.

CONFLICT OF INTEREST

The authors have disclosed no conflicts of interest. RD is a member of Jordan’s National Committee for Stem Cell Research, which develops policy for stem cell research and cord blood banking, but receives no financial compensation.

REFERENCES

Additional Supporting Information may be found in the online version of this article at the publisher's website:

**Study questionnaire in (A) English and (B) Arabic versions.** The study questionnaire was administered at each of the six hospitals in Jordan by the author (MMM) and a trained researcher, both of whom answered questions and provided explanations prior to and during completion of the questionnaire. Communication was limited to clarification about terms or interpretation of the questions without giving direction regarding responses. The questionnaire distributors, who were both female in order to prevent potential gender-related discomfort among survey participants, approached women above age 18 who were present in the maternity clinics’ waiting room and gave a short introduction about the study. It was anticipated that most women would have minimal prior knowledge of CB banking, so standardized basic information and relevant terms (stem cell, stem cell transplant, public/private/hybrid CB bank) were provided on the front page of the survey. Most questions were in either multiple-choice format or on a scale of 1 (least/lowest) to 5 (most/highest). All responses were self-reported.

**Participant information form in English (C) and Arabic (D) versions.** This form was given to participants with the study questionnaire in order to provide details about participation in the study.
Table S1. Self-reported knowledge on topics related to cord blood (CB) banking. At the time of the survey, most respondents (62%, n = 511) said they had never heard of CB banking before, including 64% (n = 310) of women born in Jordan. Variables were categorized as being “high” (4 and 5), “neutral” (3), and “low” (1 and 2) to indicate their pre-existing level of knowledge on topics related to CB banking.

Table S2. Respondents’ familiarity with cord blood (CB) banking according to socio-demographic characteristics. For (b), respondents used a scale of 1 (no knowledge) to 5 (a lot of knowledge), with the results grouped as following: “high” (4 and 5), “moderate” (3), and “low” (1 and 2).

Table S3. Participants’ reported likelihood of storing cord blood (CB) in public vs. private banks according to socio-demographic characteristics. For (b) and (c), respondents used a scale of 1 (strongly disagree) to 5 (strongly agree), with the results grouped as following: “agree” (4 and 5), “disagree” (1 and 2), and “DN” (3).

Table S4. Ethical acceptability of and willingness to participate in cord blood (CB) banking. Respondents reported their attitudes and opinions about specific aspects of CB banking, including the ethical acceptability of transplants and research, and willingness in store CB if possible, in the future in different types of banks. Variables were categorized as being “agree” (4 and 5), “neutral” (3), and “disagree” (1 and 2).

Table S5. Reasons for participants’ preferred cord blood (CB) bank location and relationship to income. There was significant correlation between income level and preference for CB storage locally versus internationally. Respondents were allowed to select more than one reason for their preferred CB bank location. Locations outside of Jordan included North America, Europe, Asia, and the Middle East (excluding Jordan).